a specific carotenoid, oscillaxanthine. Its presence in the lakes in and around the Swiss Central Plateau during past centuries – even some 13,000 years ago – has likewise been established.

In the sediments of shallow lakes, carotenoids of photoautotrophic bacteria have also been observed. Okenone is widespread, currently particularly known from *Chromatium okenii, Chromatium weissii* and *Thiopedia*. Due to their anaerobic photosynthetic nature, the presence of their pigments in sediment strata are an indication that at the time of sedimentation, no oxygen was present at the floor of the lake or in the adjacent water zones, e.g. in the Lake of Cadagno (1950 m above sea level) for many centuries and in the Rotsee near Lucerne at least since the year 1300.

Stratigraphic study of pigments enables research into natural postglacial developments and into recent eras influenced by civilization.

Lichens as indicators of air pollution (zone scales of Geneva)

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Lichens are dual, algo-fungal, organisms which are often stated to be primary colonizers of substrates such as rock. However, in such a function and depending upon environmental conditions such as temporary humidity, they can be preceded by cyanobacterial pioneers developing not only as 'Tintenstriche' on calcareous alpine cliffs[1] but also on urban walls of concrete *(Chrysocapsa*[2]*)*. Such 'blue green algae' including *Gloeocapsa sanguinea* and *Chroococcus lithophilus*[3] share their resistance to air pollution with the subaerial green alga *Pleurococcus vulgaris* intermixed with a dematiaceous mold, *Coniosporium aeroalgicolum*[4] colonizing the bark of tree trunks in soot-polluted city areas. Only a few crustose lichens such as species of *Lepraria, Lecanora* (*L. dispersa*, etc.) and *Caloplaca* (*C. citrina, lithophila*, etc.) are equally poleo-resistant; *Lecanora conizaeoides* is especially noticeable in being a selective benefitor of air pollution but its remarkable resistance to SO_2 under acid conditions remains unexplained[5].

The sensitivity of lichens to air pollution upgrades from such crustose to fruticulose species (*Evernia, Usnea* spp., etc.) through the intermediary foliose types (*Physcia, Parmelia, Xanthoria* spp.). Crustose types are more or less embedded in their substrate, bark or rock, which can have a high base content as that of asbestos tiles or limestone walls providing them additional protection against acidic pollutants[6]; the reduction of their receptive surface is another factor of their poleoresistance.

In a general way, the extreme susceptibility of lichens to air pollution has been ascribed to their indiscriminate and rapid absorption of solutes over the thallic surface, their accumulation of pollutants without excretion possibility and their slow metabolic rate[7]. Such differential pollution sensitivity of lichens has led many researchers to use them as indicators of air pollution in urban and suburban areas and to propose sensitivity scales to evaluate their poleo-tolerance parallely to the chemical assays of pollutants (SO_2, NO_x, O_3, ...)[8]. From the start[9] it has been concluded that lichen distribution corresponded markedly with the levels of air pollution, mainly SO_2. It has been shown that 100 ppb of gaseous SO_2 can produce deleterious effects on lichen metabolism, but that such effects could be reversed in an SO_2-free atmosphere[10]. In an epiphytic *Evernia* species, metabolic processes such as photosynthetic CO_2-fixation, protein and lipid biosynthesis were found to be very sensitive to SO_2[11]. Photochemical oxidizing agents, such as ozone and PAN (peroxyacetylnitrate) have also been found to induce a decrease in the photosynthesis of lichens[12]. As for NO_x, it would only be toxic in synergic action with the other pollutants among which SO_2[13]. However, the lichen scarcity in built-up areas might partially at least, also reflect the low humidity of these areas. It is now widely admitted that both factors interact and that pollution is the overriding factor of the scarcity of lichens in wide areas surrounding cities. The main value of zone scales is that, "where correlations with pollutant levels have been established, large areas can be surveyed quickly and maps produced which give a valuable indication of pollution patterns"[8]. In Switzerland, Vareschi[14] had mapped Zürich in 1936; his polluted zones have greatly expanded until the most recent mapping of epiphytes of that city by Züst[15].

In Geneva, Turian and Desbaumes[16] have described three centrifugal belts of isopollution by SO_2: the 'greyish belt' ($\sim$ 1 km diameter) of the marker *Physconia grisea* circling the downtown lichenic desert area (only the Cyanobacteria, *Pleurococcus* + *Coniosporium*, and a few crustaceous epilithic lichens) assayed at $\sim$ 100 µg SO_2/m^3 in 1975; the 'yellow belt' ($\sim$ 2 km diameter) of *Xanthoria parietina* resisting at 60–70 µg SO_2/m^3; the 'green belt' of *Parmelia caperata* (not resistant over 50 µg SO_2/m^3), at only 2.5 km from the center of Geneva in 1975–1984, but at 25 km in Paris[7] and at least 40 km in London[8]. Among other markers, *P. scortea* is noticeable on tree trunks of the peripheral parks (Mont-Repos); it is sterile there while fertile (brownish apothecia) in Verbois ($\sim$ 10 km from the center). *Evernia prunastri* shows reduced fruticulous thalli in Grand-Lancy (3 km from center) while *Anaptychia ciliaris* occurs but sterile at Aire-la-Ville ($\sim$ 10 km).

In some areas of the canton of Geneva the situation is still deterioting. A recent example is that of the colonies of *Parmelia caperata* epiphytic on the bush trunks at the boundary of the forest fronting at 2 km south-west. the long axis of the aeroport of Cointrin; central brown-black necrotic spots which were small when photographed in 1974[16] have greatly expanded and some colonies have practically vanished except their peripheral greenish crown (Turian, unpubl. observations, March 1984). In other cases, the air quality has improved as in London (U.K.) where mean SO_2 levels have fallen markedly during the past 15 years. A survey of many sites demonstrated in 1981 that several species among which *P. sulcata* and even *P. caperata*, extinct or very rare in those areas in 1970, have extended their range considerably[17].

Similar improvement has also been noticed in the city of Geneva where air pollution by SO_2 could be reduced by half (J.-C. Landry, oral communication), with a parallel recolonization of the *Populus* trunks on the right bank of the river Arve (Quai Ernest-Ansermet) by still small colonies of *Xanthoria parietina* bearing scarce apothecia on 2–3 cm diameter thalli (Turian, unpubl. observations, 1984).

As a conclusion for the 1983–84 status of the air pollution in the urban zone of Geneva evaluated by lichen indicators, we can still circumscribe its lichen desert to ~ 1 km radial transects from the center (Place Bel-Air) but with local desert spots in a 3 km diameter restricted to a few highly polluted places of heavy traffic (Place Cirque, Rond-Point des Eaux-Vives, de Plainpalais, etc.). According to our scale of increasing sensitivity, such desert zones bear as only epiphytes the green *Pleurococcus vulgaris* more or less blackened by its fungal partner, *Coniosporium aeroalgicolum*. Epilithic crustaceous lichens can however be observed on walls of basic stones, with blackish, vertical streaks of Cyanobacteria (Conservatory of Music, etc.)[3]. First epiphytic lichens such as *Physconia grisea* can appear in the peripheral parks (Bastions, less than 1 km from the center), closely followed by *Parmelia sulcata* and *scortea* and preceding the yellow *Xanthoria parietina* now noted at less than 2 km from the center.

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ABSTRACTS

1. Oral Presentations
Medical Microbiology and Virology

Constitutive and ironchelator-inducible hemolysin production of *Escherichia coli*

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Investigating *E. coli* wild strains of our region 14% of 762 strains from fecal flora and 33% of 405 strains causing infections of the urinary tract were hemolytic. 5 strains from the fecal flora could transfer their hemolytic character by conjugation. Their Hly-plasmids are derepressed and determine the production of F-type-pili. 4 of them belong to the FVI, one to the FIV incompatibility group. For the quantification of the hemolysin production we developed a standard method in liquid broth. The hemolysin excretion of all strains can be reduced by $FeCl_3$. This points to a possible correlation between hemolysis and iron metabolism. On the other hand a 10- to 100-fold increase in hemolysin production is observed only by our 5 strains with Hly-plasmids when grown in the presence of iron chelators. The other hemolysin producing strains do not show this effect.

R-plasmid-harboring *Escherichia coli* can secrete beta-lactamases

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We investigated log-phase cultures of ampicillin-resistant *E. coli* wild strains for the ability to secrete R-plasmid mediated beta-lactamases. Most of these strains released beta-lactamases into the liquid media. The R-factors of these strains were transferred into *E. coli* K_{12}921 and enabled the new host to synthesize and secrete beta-lactamases. Mucus producing ampicillin-resistant wild strains did not secrete beta-lactamases. But corresponding transconjugant clones of *E. coli* K_{12}921 released the enzyme into the liquid media. The activity of secreted enzymes varied in a great range between the different strains and did not correlate with the MIC. Secreted and periplasmatic stored beta-lactamase-activity was quantified and the different types of beta-lactamases were determined by isoelectro-focusing.

Plasmid-mediated resistance to phages and colicins

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From a patient with urogenital infections we isolated a colicin producing strain of *E. coli* which is resistant to all tested colicins and phages. After conjugation to a recipient strain of *E. coli* K_{12}921 $r^-m^-lac^-$ we found colicin producing transconjugants which received in 10% lac-property. This lac-positive transconjugant as well as the wild-donator are resistant to colicins (A-, B-, D-, E1-, E2-, E3-, G-, H-, Ia-, Ib-, K-, M- and V-colicin) and also to T2-, T3-, T4-, T5-, T6-, T7-phages and λ-phages, whereas the transconjugant without lac-property is sensitive to these colicins and phages. The wild strain and the lac-positive transconjugant multiply MS_2 phages. The lac-property-giving plasmid is therefore conjugative and of F-pili-type. In the agarose-gel-electrophoresis the colicin producing lac-negative transconjugant shows only one plasmid of about 50 kbp whereas the wild strain and the lac-positive transconjugant have two plasmids of about the same size. The consequence of this plasmid for hospital hygiene is discussed.